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06-10-05

ATTORNEY DOCKET NO. 10010323-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Mark T. Sullivan et al.

Serial No.: 09/933,606 **Examiner:** Hwa S. Lee

Filing Date: August 20, 2001 **Group Art Unit:** 2877

Title: Combination of Fiber Optic Light Beams

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on April 8, 2005.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) **$500.00**.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)(1)-(5)) for the total number of months checked below:

☐	one month	$ 120.00
☐	two months	$ 450.00
☐	three months	$1020.00
☐	four months	$1590.00

☐ The extension fee has already been filled in this application.

☒ (b) Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **50-1078** the sum of $500.00. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account **50-1078** pursuant to 37 CFR 1.25.

A duplicate copy of this transmittal letter is enclosed.

Respectfully submitted,

Mark T. Sullivan et al.

By David Millers

David T. Millers
Attorney/Agent for Applicant(s)

Reg. No. 37,396

Date: June 8, 2005

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Kerry Bagwell, Carol J. Courville, and Paul Zorbedian		
Assignee:	Agilent Technologies, Inc.		
Title:	DIRECT COMBINATION OF FIBER OPTIC LIGHT BEAMS		
Serial No.:	09/933,606	Filing Date:	August 20, 2001
Examiner:	Hwa S. Lee	Group Art Unit:	2877
Docket No.:	10010323-1		

San Jose, California
June 8, 2005

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APPEAL BRIEF

Dear Sir:

Pursuant to 35 U.S.C. § 134 and 37 C.F.R. §§ 1.191 and 41.37, Applicants submit this Appeal Brief, which follows the Notice of Appeal submitted for the above-identified patent application on April 8, 2005.

I. REAL PARTY IN INTEREST

The real party in interest is the assignee, Agilent Technologies, Inc.

II. RELATED APPEALS AND INTERFERENCES

Based on information and belief, there are no appeals or interferences that could directly affect or be directly affected by or have a bearing on the decision by the Board of Patent Appeals in the pending appeal.

III. STATUS OF CLAIMS

Claims 7-9 and 30-33 are pending in this case and all stand rejected. Claims 1-6 and 10-29 were canceled during prior prosecution of the application.

IV. STATUS OF AMENDMENTS

There are no unentered amendments in this case. An amendment dated January 26,

2005, which was filed subsequent to the final rejection dated November 26, 2004, appears to have been entered by the Examiner. (Appellants note that the Advisory Action dated March 9, 2005, listed the amended claims set 7-9 and 30-33 as pending, which reflected the cancellation of claims in the amendment filed January 26, 2005, but neither of the boxes on the Advisory Action used to indicate whether or not the amendment was entered were checked.) Pending claims 7-9 and 30-33 in the amended form presented on January 26, 2005 appear in a Claims Appendix.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 7 is generally directed to an interferometer (200) that employs a source (210) of a heterodyne beam and structures (220) for splitting the heterodyne beam into components of having different frequencies. The separated components can be transmitted on optical fibers (250, 255), and at least one acousto-optic modulator or AOM (230 or 235) acting on at least one of the components can increase a frequency difference between the components. A recombining unit (260) combines the separated components after the increase in the frequency difference to provide a recombined heterodyne beam (COut) that is input to interferometer optics (290). This advantageously permits splitting of the heterodyne beam into multiple heterodyne beams, each of which can be separately split into a measurement beam and a reference beam for a corresponding measurement axis. In order to produce a recombined beam in which the frequency components are sufficiently collinear for use in a precision interferometer, the interferometer employs a manipulator (400) on which a fiber optic cable assembly is mounted. The manipulator (400) can then control a beam exiting from the fiber optic cable assembly to permit recombination of the component beams into the heterodyne beam having suitable properties for an interferometer.

VI. GROUNDS OF REJECTIONS TO BE REVIEWED ON APPEAL

A. Claims 7-9 and 30-33 were rejected under 35 U.S.C. § 112, second paragraph.

B. Claims 7-9 and 31-33 were rejected as unpatentable under 35 U.S.C. 103(a) over U.S. Pat. No. 5,793,487 in view of U.S. Pat. Nos. 5,327,222, 5,781,295, and 4,492,426.

C. Claim 30 was rejected as unpatentable under 35 U.S.C. 103(a) over U.S. Pat. No. 5,793,487 in view of U.S. Pat. Nos. 5,327,222, 5,781,295, 4,492,426, and

5,767,971.

VII. ARGUMENTS

A. Claims 7-9 and 30-33 meet the requirements set forth under 35 U.S.C. § 112, second paragraph.

In the Final Office Action dated November 26, 2004, the Examiner rejected claims 7-9 and 30-33 under 35 U.S.C. § 112, second paragraph and particularly indicated that claim 7 (as then pending) was unclear with regard to whether the beams go into the interferometer optics before or after the beam recombining unit. Claims 8, 9, and 30-33 were apparently rejected under 35 U.S.C. § 112, second paragraph for depending from claim 7 since the Final Office Action did not give any specific grounds for rejecting claims 8, 9, or 30-33.

In the January 26, 2005 response to the Final Office Action, Appellants amended claim 7 to the form shown in the Claims Appendix. In particular, claim 7 as set forth below recites, "a beam-combining unit positioned to receive the first and second beams and provide the recombined heterodyne beam to the interferometer optics." The Advisory Action dated March 9, 2005 failed to indicate whether the amendment to claim 7 obviated the rejection under 35 U.S.C. § 112, second paragraph. However, claim 7 in its current form clearly indicates that recombined beam enters the interferometer optics, and claims 7-9 and 30-33 meet the requirements of 35 U.S.C. § 112.

B. Claims 7-9 and 31-33 are patentable under 35 U.S.C. § 103(a) over U.S. Pat. Nos. 5,793,487 in view of U.S. Pat. Nos. 5,327,222, 5,781,295, and 4,492,426.

Claims 7-9 and 31-33 stand rejected under 35 U.S.C. 103 over U.S. Pat. No. 5,793,487 (hereinafter Takahashi) taken with U.S. Pat. No. 5,327,222 (hereinafter Takamiya), U.S. Pat. No. 5,781,295 (hereinafter Fuchs), and U.S. Pat. No. 4,492,426 (hereinafter Nicia). The Examiner erred in this rejection in that claim 7 distinguishes over the combination of Takahashi, Takamiya, Fuchs, and Nicia at least by reciting,

> "a beam splitter positioned to split the heterodyne beam into a first beam and a second beam having different frequencies; ... interferometer optics that generate measurement and reference beams from a recombined heterodyne beam; and a beam-combining unit positioned to receive the first and second beams and provide the recombined heterodyne beam to the interferometer optics, wherein the beam combining unit comprises: a beam combiner; a first optic cable assembly that carries the first beam; a

second optic cable assembly that carries the second beam to the beam combiner; and a first manipulator on which the first fiber optic cable assembly is mounted."

Of the four references used in the rejection, only Fuchs and Nicia disclose combining beams from optical fibers. Takahashi illustrates only systems having free space optical paths and does not mention optical fibers. Takamiya similarly illustrates measurement systems having free space optical paths and only mentions optical fibers in regard to optical fiber communications. (See, for example, Takamiya, column 2, line 8.)

Nicia mentions combining of beams, but Nicia fails to disclose an interferometer and fails to suggest use of an optical coupler in an interferometer.

Fuchs discloses an interferometer in which separate light transmitting fibers 8 and 9 such as illustrated in Fig. 1 of Fuchs deliver beams of different frequency to an interferometer unit 12. A beam from fiber 8 reflects from a measurement reflector 11 before being directed into a beam splitter 14 that combines the reflected measurement beam with the beam from fiber 9. A multimode fiber 17 then guides the combined beam to an evaluating unit 18. See for example, Fuchs beginning at column 3, line 54. Fuchs fails to suggest a recombination that produces a heterodyne beam from which measurement and reference beams are extracted.

The combination of Takahashi, Takamiya, Fuchs, and Nicia provides no suggestion of combining beams from optical fibers for subsequent splitting into measurement and reference beams. Of the cited references that mention combining beams from fibers, Fuchs only describes recombination of measurement and reference beams for final analysis, not for subsequent splitting into measurement and reference beams, and Nicia fails to even mention interferometers.

Further, the combination of Takahashi, Takamiya, Fuchs, and Nicia fails to suggest a recombining unit with fiber optics would be suitable (e.g., provide a recombined beam of sufficient collinearity) for extraction of measurement and reference beams. To the contrary, Fuchs suggests that recombination increases variation in the combined beam in that Fuchs discloses using monomode fibers 8 and 9 for input beams and a multi-mode fiber 17 for the output beam measured. Nicia doesn't mention interferometers, and the detailed description of Nicia concentrates on beam splitting without indicating suitability for beam combining operations.

In accordance with an aspect of Applicants' invention, the use of fiber optics allows system components such as lasers and AOMs that produce heat or vibrations to be remote from the interferometer optics, and sending separate beams on separate fibers avoids cross-talk between the polarization components. Further, provision of a

recombined heterodyne beam to interferometer optics can facilitate a compact implementation of multiple measurement axes in the interferometer optics. The combination of Takahashi, Takamiya, Fuchs, and Nicia fails to suggest these advantages or Applicants' solution of using a beam combiner with manipulators for one or both of the optical fibers to provide a recombined beam that is sufficiently collinear for use as the source of separated reference and measurement beams.

For the above reasons, Applicants respectfully submit that independent claim 7 and claims 8, 9 and 31-33, which depend from claim 7, are allowable.

C. Claim 30 is patentable under 35 U.S.C. 103(a) over U.S. Pat. Nos. 5,793,487 in view of U.S. Pat. Nos. 5,327,222, 5,781,295, 4,492,426, and 5,767,971.

Claim 30 stands rejected under 35 U.S.C. 103 over Takahashi in view of Takamiya, Fuchs, and Nicia and further in view of U.S. Pat. No. 5,767,971 (hereinafter Kawai).

Claim 30 depends from claim 7, which is patentable over the combination of Takahashi, Takamiya, Fuchs, and Nicia for the reasons noted above. In particular, the combination fails to suggest combining beams from optical fibers for subsequent splitting into measurement and reference beams.

Kawai is directed to systems for measuring refractive indices and displacements, and like Takahashi and Takamiya, Kawai fails to mention or suggest combining beams from optical fibers. Combining the fifth reference, Kawai, to Takahashi, Takamiya, Fuchs, and Nicia does not affect the arguments given above to show that claim 7 is patentable. Accordingly, claim 7 and claim 30, which depends from claim 7, are patentable over Takahashi, Takamiya, Fuchs, Nicia, and Kawai.

For the above reasons, Appellants submit the present rejection of the above-identified patent application is unfounded, and Appellants request that the rejections of claims 7-9 and 30-33 be reversed.

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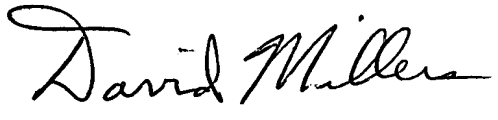
Respectfully submitted,



David Millers
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CLAIMS APPENDIX

Claims 7-9 and 30-33, which are the claims involved in this appeal, are copied below.

7. An interferometer comprising:

a source of a heterodyne beam;

a beam splitter positioned to split the heterodyne beam into a first beam and a second beam having different frequencies;

a first AOM in a path of the first beam, the first AOM operating to increase a difference between frequencies of the first and second beams;

interferometer optics that generate measurement and reference beams from a recombined heterodyne beam; and

a beam-combining unit positioned to receive the first and second beams and provide the recombined heterodyne beam to the interferometer optics, wherein the beam combining unit comprises:

a beam combiner;

a first optic cable assembly that carries the first beam;

a second optic cable assembly that carries the second beam to the beam combiner; and

a first manipulator on which the first fiber optic cable assembly is mounted, the first manipulator being adjustable to control a direction of the first beam upon exit from the first fiber optic cable assembly, wherein adjustment of the first manipulator controls an incident angle of the first beam on the beam combiner.

8. The interferometer of claim 7, wherein the beam-combining unit further comprises a second manipulator on which the second fiber optic cable assembly is mounted, the second manipulator being adjustable to control a direction of the second beam upon exit from the second fiber optic cable assembly, wherein adjustment of the second manipulator controls an incident angle of the second beam on the beam combiner.

9. The interferometer of claim 7, wherein the first manipulator is further adjustable to translate the first beam upon exit to control an incident location of the first beam on the beam combiner.

30. The interferometer of claim 7, further comprising a second AOM in a path of

the second beam, the second AOM changing a frequency of the second beam.

31. The interferometer of claim 7, wherein the source of the heterodyne beam comprises:

a laser; and

an optical element in a path of the heterodyne beam between the laser and the beam splitter, wherein in the heterodyne beam exiting the optical element, a first frequency component has a first frequency and a first linear polarization and a second frequency component has a second frequency and a second linear polarization that is orthogonal to the first linear polarization.

32. The interferometer of claim 31, wherein the laser employs Zeeman splitting to provide the heterodyne beam with frequency components respectively having the first frequency and the second frequency.

33. The interferometer of claim 31, wherein the beam splitter is a polarizing beam splitter that uses the first and second linear polarizations of the first and second components to separate the first and second components and split the heterodyne beam into the first and second beams.